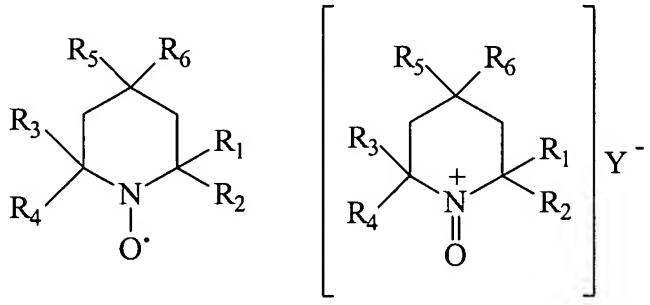
WHAT IS CLAIMED IS:

1. A process for oxidizing primary and secondary alcohols to aldehydes and ketones, said process comprising reacting the primary or secondary alcohol with an oxidant wherein said alcohol is in a solution including a catalyst selected from the group comprising 2,2,6,6,-tetramethylpiperidinyloxy catalysts and further in the presence of a co-catalyst, wherein the co-catalyst is selected from the group comprising oxymetal ions and salts thereof, said alcohol acting as the substrate in said solution.

2. The process of claim 1, where said primary and secondary alcohols are selected from the group comprising methanol, ethanol, n- and isopropyl alcohol, n-, iso- and sec-butyl alcohol, pentyl alcohol, hexyl alcohol, neopentyl alcohol, neohexyl alcohol, octyl alcohol, lauryl alcohol, tridecyl alcohol, myristyl alcohol, nonadecyl alcohol, eicosyl alcohol, unsaturated alcohols including but not limited to allyl alcohol, crotyl alcohol and propargyl alcohol, and aromatic alcohols including but not limited to benzyl alcohol, phenyl ethanol, and phenyl propanol.

3. The process of claim 1, wherein' said 2,2,6,6, -tetramethylpiperidinyloxy catalyst is selected from the group consisting of catalysts having the formulas:



(II) (III)

wherein R_1, R_2, R_3 and R_4 independently lower alkyl or substituted alkyl groups of the same or different structures , R_5 and R_6 are both hydrogen or are lower alkoxy or one is hydrogen and the other is lower alkoxy, hydroxy, amino, alkyl or dialkylamino, alkylcarbonyloxy, alkylcarbonylamino, or can be jointly substituted by an oxygen or a ketal, and the Y^- is an anion.

4. The process of claim 3 wherein the 2,2,6,6,-tetramethylpiperidinyloxy catalyst is present in an amount of 0.001-10 mol% of the substrate alcohol.

5. The process of claim 3 wherein said TEMPO based catalyst is selected from the group consisting of 4-methoxy-TEMPO, 4-ethoxy-TEMPO, 4-acetoxy-TEMPO, 4-acetamino-TEMPO, 4-hydroxy-TEMPO, 4-benzoyloxy-TEMPO, 4-amino – TEMPO, N, N-dimethylamino-TEMPO, 4- oxo-TEMPO, poly [(6-[1,1,3,3-tetramethylbutyl)amino]-s-triazine-2, 4-diyl], [(2,2,6,6-tetramethyl-4-piperidyl)imino] hexamethylene[(2,2,6,6-tetramethyl-4-piperidinyl)imino]] and combination of these.

6. The process of claim 1 wherein the co-catalyst is selected from the group of oxymetal cations comprising TiO^{2+}, VO^{2+}, CrO_2^{2+}, ZrO^{2+}, MoO_2^{2+}, WO_2^{2+} and the group of anions comprising MoO_4^{2-}, WO_4^{2-}, VO_3^-, $H_2PO_4^{2-}$, $B_4O_7^{2-}$.

7. The process of claim 6 wherein the co-catalyst is $Na_2B_4O_7$ or ZrO (acetate)$_2$.

8. The process of claim 6, wherein the co-catalyst concentration is 0.01 – 20 % mol of the substrate alcohol.

9. The process of claim 1, wherein the oxidant is selected from the group comprising sodium hypochlorite, potassium hypochlorite, calcium hypochlorite, sodium chlorite, hydrogen peroxide, tert-butyl hydroperoxide, trichloroisocyanuric acid, peracetic acid, performic acid, trichloroperacetic acid and trifluoroperacetic acid.

10. The process of claim 9 wherein the ratio between the oxidant and the alcohol is in the range of from about 1:0.8 to 1:1.5.

11. The process of claim 1, further comprising the addition of one or more additional solvents to the alcohol solution.

12. The process of claim 11 wherein said solvent is selected from the group comprising: water, acetonitrile, acetone, tetrahydrofuran, benzene, toluene, methyl *tert*-butyl ether, methylene chloride, chloroform, carbon tetrachloride, pentane, hexane, heptane, ethyl acetate, methyl acetate and a mixture of solvents from the group above.

13. The process of claim 1, wherein the oxidation is carried out in absence of an additional solvent.

14. The process of claim 1, wherein a buffer solution is added to the alcohol solution.

15. The process of claim 14 wherein said buffer solution comprises a solution of $NaHCO_3$, $KHCO_3$, Na_2CO_3, K_2CO_3, K_2PO_4, Na_2HPO_4, NaH_2PO_4, K_2HPO_4, KH_2PO_4, NaOAc and any combination thereof sufficient to maintain a pH of from about 4 to about 12.

16. The process of claim 1, wherein the reaction temperature is maintained in the range of -10°C to 50°C.

17. The process of claim 14, wherein a bleach solution is added to the solution of alcohol and aqueous buffer while maintaining the pH of the emulsion in the range of about pH 4 –12.

18. The process of claim 17, wherein the addition time for the bleach solution is between complete addition at one time and 10 hours and the post addition reaction is continued for an additional 0 to 10 hours.

19. The process of claim 18, wherein a solution of the catalyst in the alcohol substrate is added over the buffered bleach solution, containing the co-catalyst over extended period of time while maintaining the pH of the emulsion in the range of about pH 4 –12.

20. The process of claim 1 wherein the addition time for the catalyst-alcohol solution is between complete addition at one time and10 hours and the post addition reaction is continued for an additional 0 to 30 hours.

21. The method of claim 1 comprising the additional step of purification of the crude aldehyde or ketone via distillation, fractional distillation, either batch or continuous or a thin-film evaporator.

22. A process for the production of 3,3-dimethylbutyraldehyde, comprising the step of reacting 3,3-dimethylbutanol with an oxidant wherein said 3,3-dimethylbutanol is in a solution including a catalyst selected from the group comprising 2,2,6,6,-tetramethylpiperidinyloxy catalysts and further in the presence of a co-catalyst selected from the group comprising the group of oxymetal cations comprising TiO^{2+}, VO^{2+}, CrO_2^{2+}, ZrO^{2+}, MoO_2^{2+}, WO_2^{2+} and the group of anions comprising MoO_4^{2-}, WO_4^{2-}, VO_3^-, $H_2PO_4^{2-}$, $B_4O_7^{2-}$;

23. The process of claim 22 wherein said oxidant is selected from the group comprising comprising sodium hypochlorite, potassium hypochlorite, calcium hypochlorite, sodium chlorite, hydrogen peroxide, tert-butyl hydroperoxide, trichloroisocyanuric acid, peracetic acid, performic acid, trichloroperacetic acid and trifluoroperacetic acid.

24. The process of claim 22 wherein the ratio between the oxidant and the alcohol is in the range of from about 1:0.8 to 1:1.5.

25. The process of claim 22 further comprising the addition of an additional solvent to the alcohol solution.

26. The process of claim 25 wherein said solvent is selected from the group comprising: water, acetonitrile, acetone, tetrahydrofuran, benzene, toluene, methyl *tert*-butyl ether, methylene chloride, chloroform, carbon tetrachloride, pentane, hexane, heptane, ethyl acetate, methyl acetate and a mixture of solvents from the group above.

27. The process of claim 22 wherein said process is carried out in the absence of a solvent.

28. The process of claim 22 wherein a buffer solution is added to the alcohol solution.

29. The process of claim 28 wherein said buffer solution comprises a solution of $NaHCO_3$, $KHCO_3$, Na_2CO_3, K_2CO_3, K_2PO_4, Na_2HPO_4, NaH_2PO_4, K_2HPO_4, KH_2PO_4, NaOAc and any combination thereof sufficient to maintain a pH of from about 4 to about 12.

30. The process of claim 29 wherein a bleach solution is added to the solution of alcohol and aqueous buffer while maintaining the pH of the emulsion in the range of about pH 4-12.

31. The process of claim 29 wherein the addition time for the bleach solution is between complete addition at one time and 10 hours and the post addition reaction time is continued for an additional 0 to 10 hours.

32. A process for oxidizing primary and secondary alcohols to aldehydes and ketones, said process comprising reacting the primary or secondary alcohol with an oxidant wherein said alcohol is in a solution including a two or more catalysts each selected from the group comprising 2,2,6,6,-tetramethylpiperidinyloxy catalysts and further in the presence of a co-catalyst, wherein the co-catalyst is selected from the group comprising oxymetal ions and salts thereof, said alcohol acting as the substrate in said solution.